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(56) Documents cited
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GB 1250229
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GB 116979
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(54) **Rotary cylinder internal combustion engine**

(57) A stator 1 provided in its interior with elliptical rolling paths 8, 25 contains a rotor 2 having a cylindrical outer surface and radially traversed by a cylinder sleeve 5 for a pair of radially reciprocable pistons 4 each supporting a roller 6 at its outward end engaging the elliptical rolling path 8. The rotor 2 is provided with a combustion chamber 10 open toward a distributor sleeve 11 secured to the stator 1 and provided with an inlet aperture (12), Figure 4 (not shown), and an exhaust aperture (13) as well as a spark plug 16 or a fuel injector. A lubricating and cooling oil feed circuit 30 to 33 extends through the engine and the oil flows therethrough due to the pumping produced at the rear of the pistons 4 during rotation of the rotor.

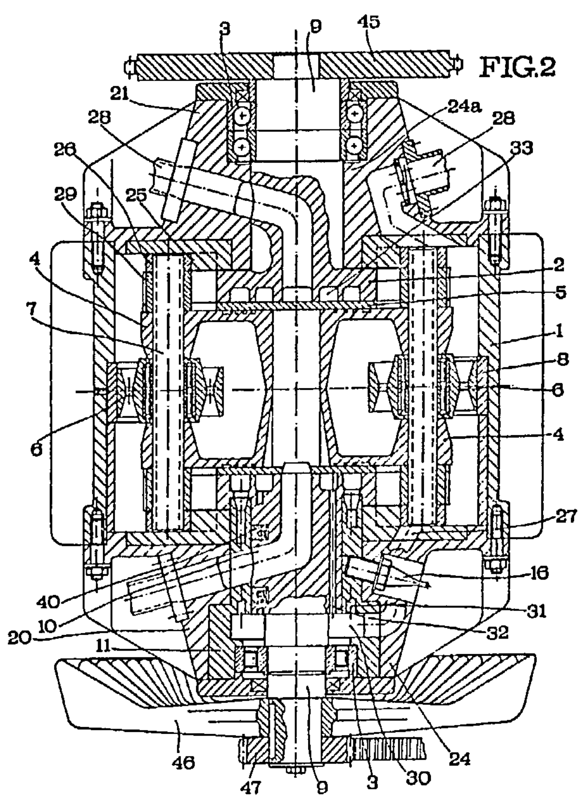

FIG.2

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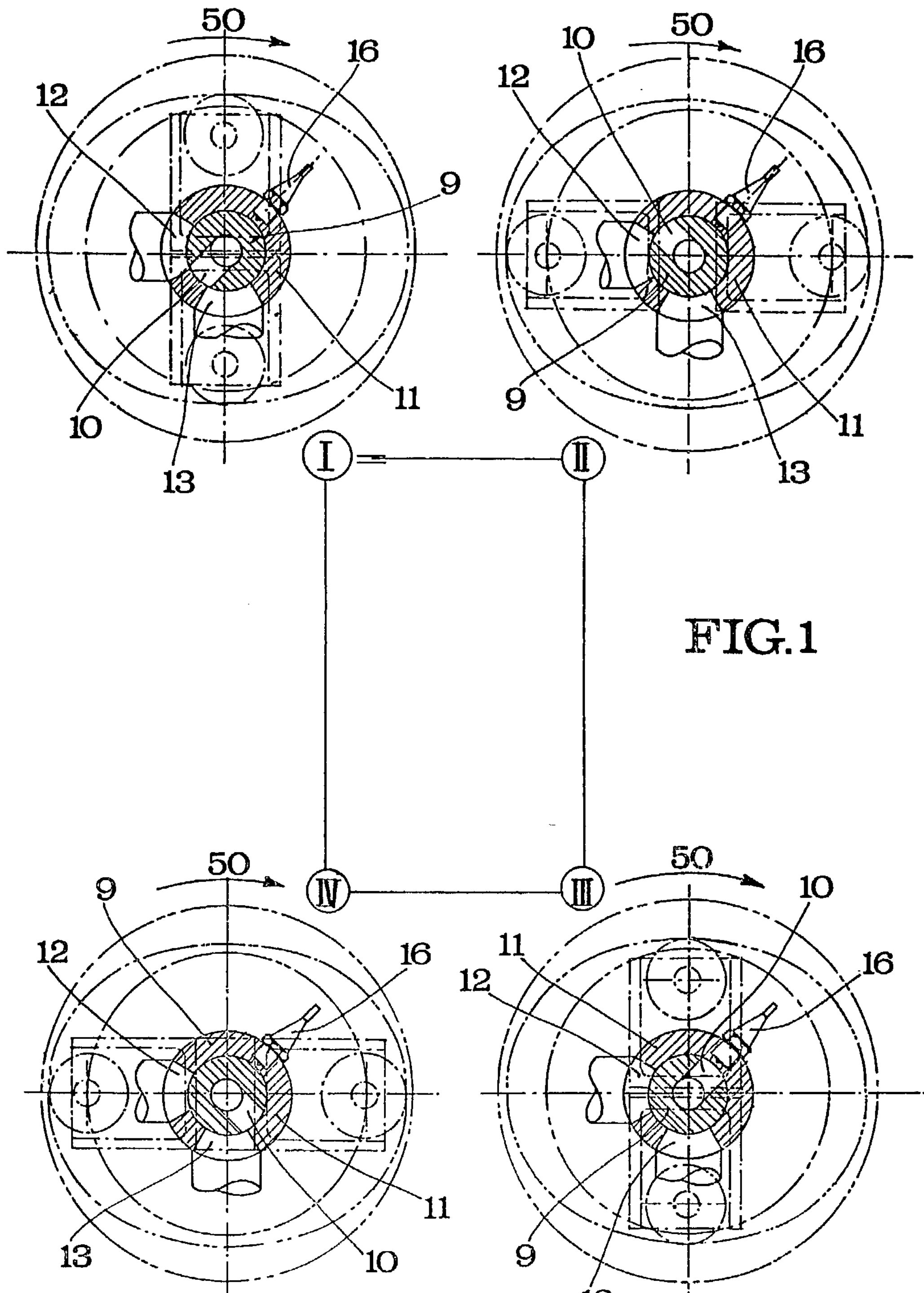
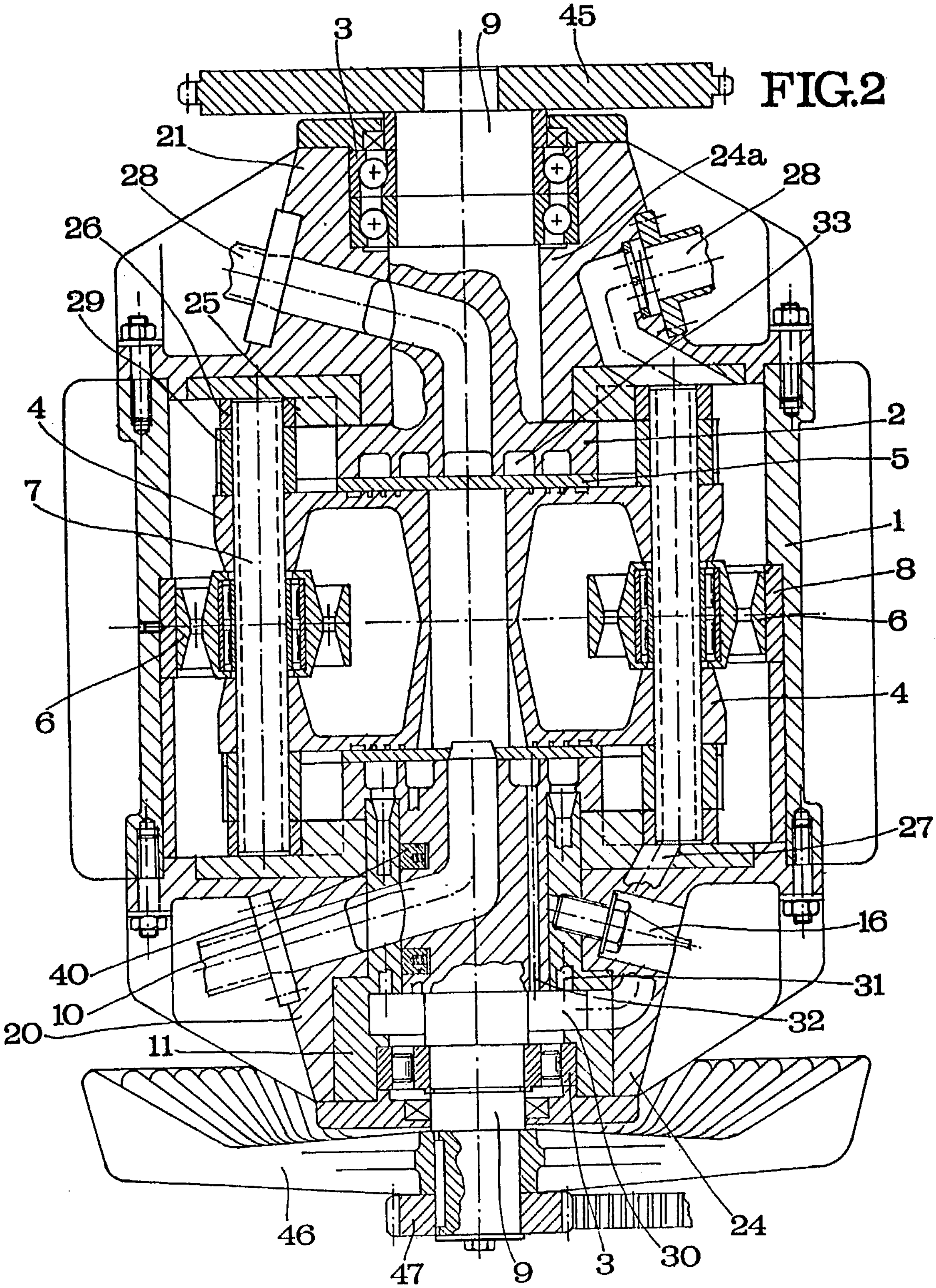


FIG.1


3
9
45
21
28
24a
28
26
33
29
25
4
2
5
7
1
8
6
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4
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16
40
31
10
32
20
11
46
47
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3
30
24

FIG.2

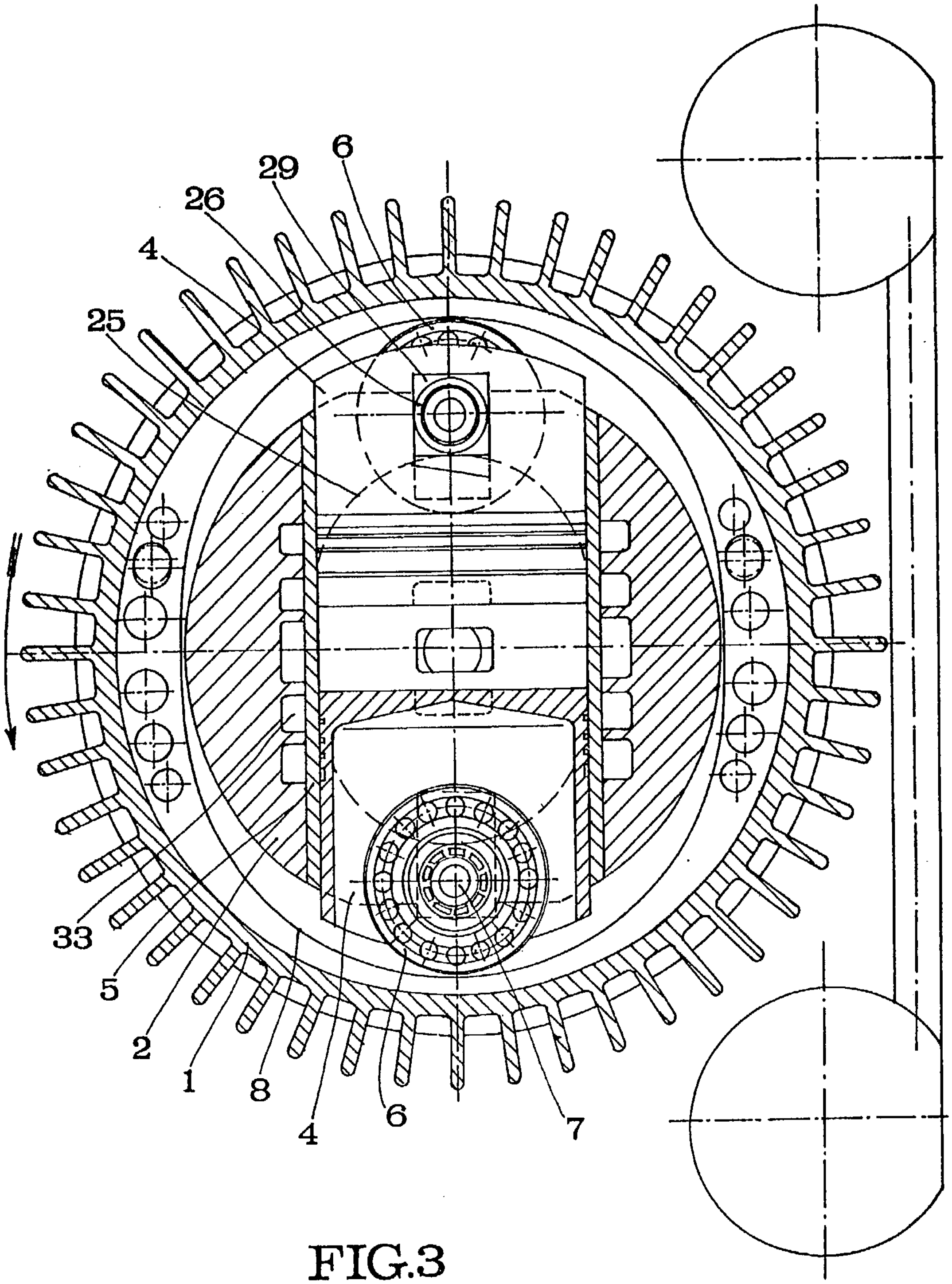
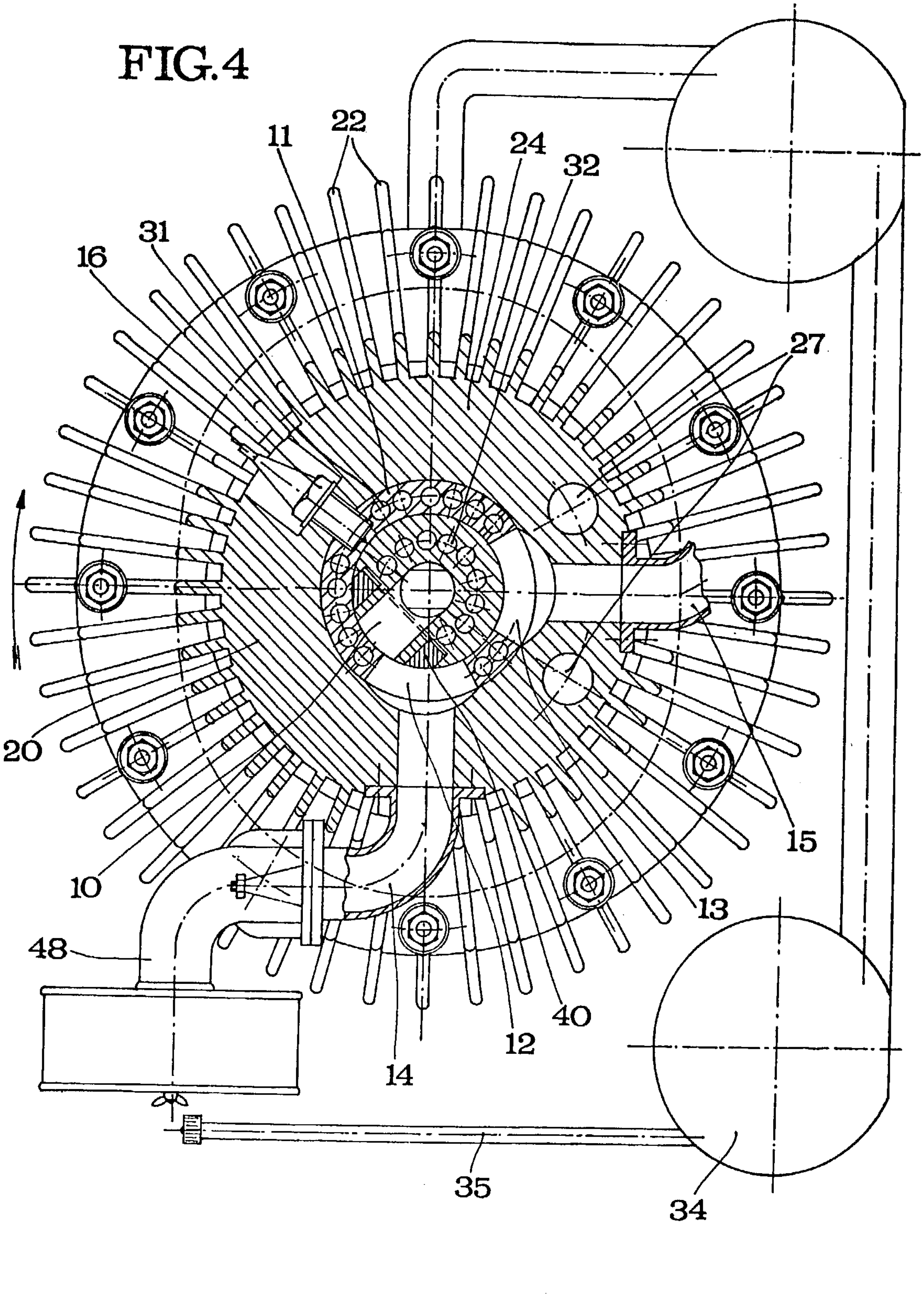


FIG.3

FIG.4



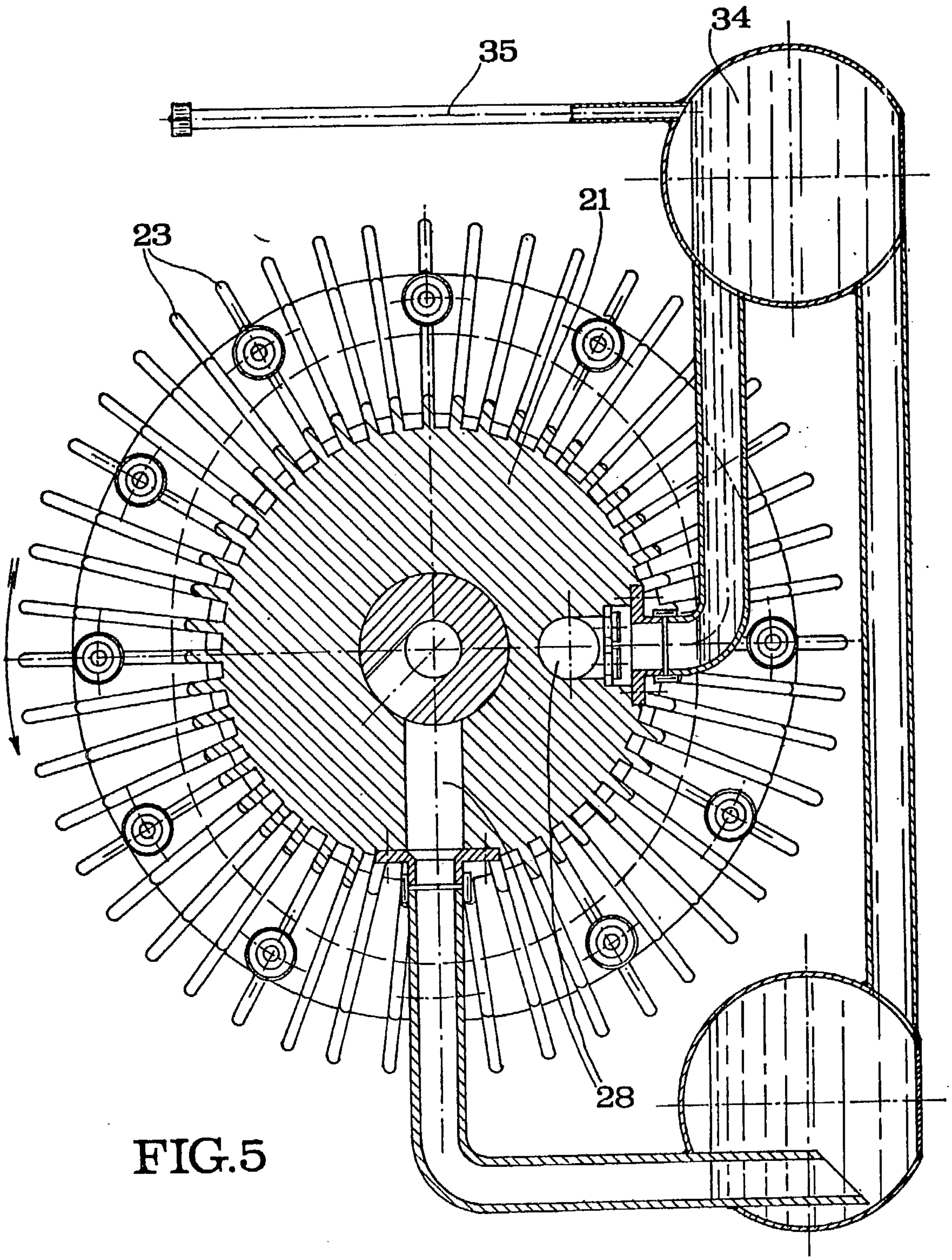
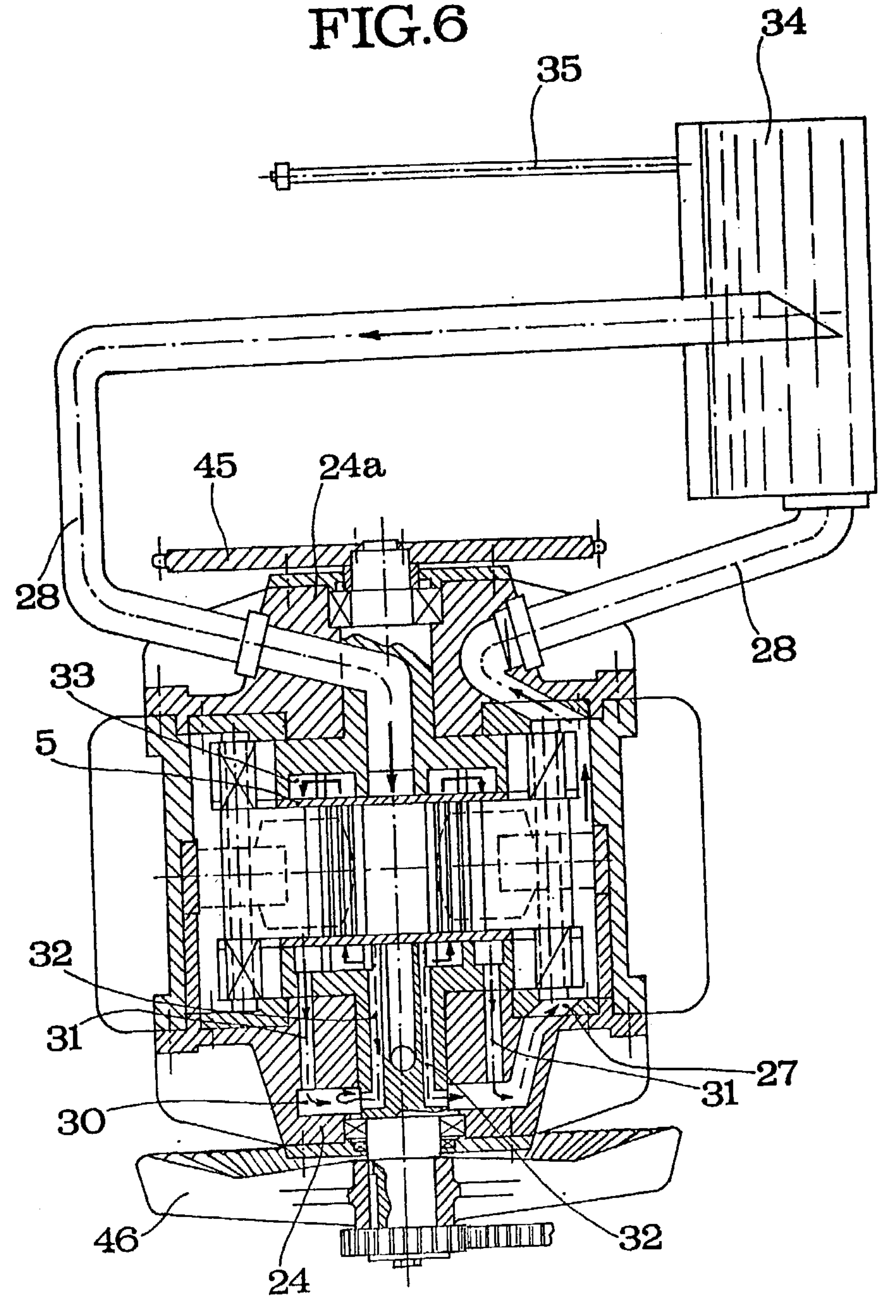


FIG.5

FIG.6



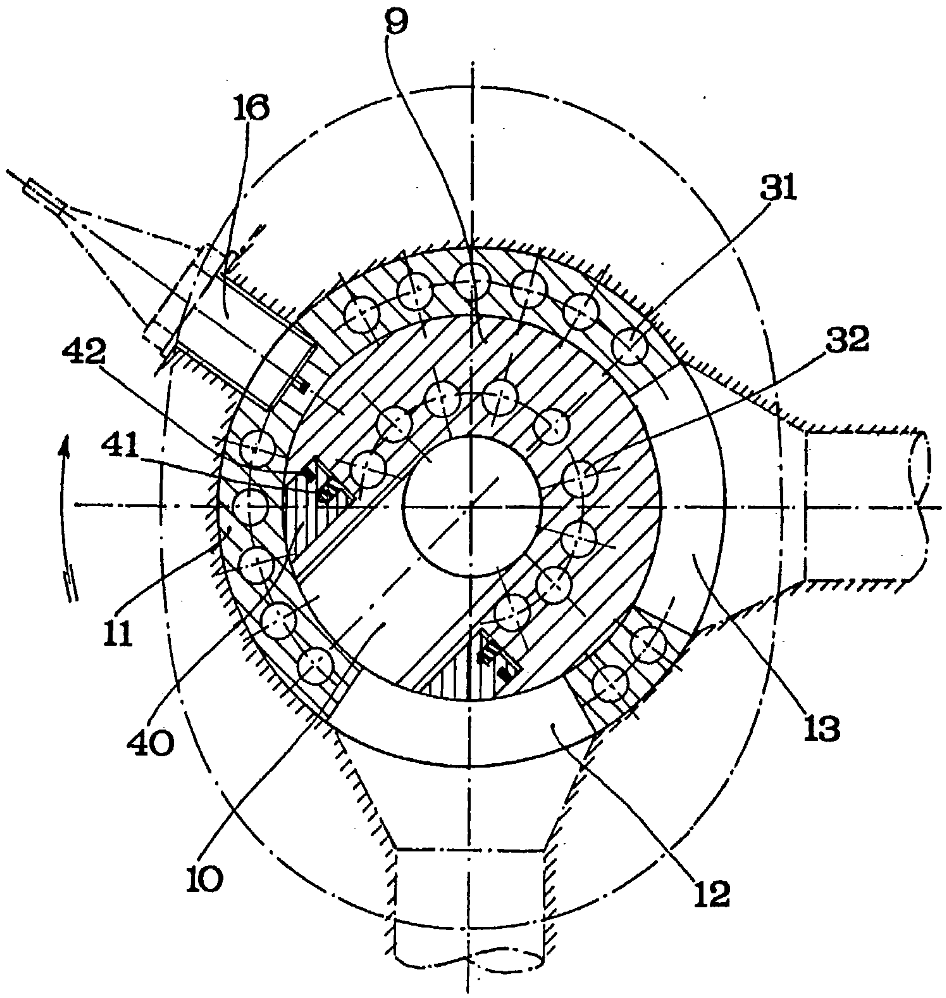


FIG.7

SPECIFICATION

Rotary combustion engine

This invention relates to a rotary combustion engine of the type comprising a substantially cylindrical stator provided in its interior with an elliptical rolling path, inlet and exhaust apertures in the stator for receiving and exhausting a combustible fuel mixture into and from the interior of the stator, ignition means secured to the periphery of the stator, said ignition means having a forward ignition end extending substantially flush and communicating with the interior of the stator, and a rotor having a cylindrical peripheral outer surface provided with a combustion chamber open toward the cylindrical peripheral outer surface, said rotor being arranged with portions of its periphery engaging the elliptical rolling path in the stator.

It is an object of the present invention to improve the efficiency of the known rotary combustion engines, provide better sealing between the rotor and the elliptical rolling path in the stator and reduce friction therebetween.

This is achieved according to the invention by providing a rotary combustion engine of the type described above, which comprises a pair of radially opposed pistons reciprocably mounted in a bearing sleeve extending radially through the longitudinal central portion of the rotor and each supporting at its radially outward end a roller arranged to engage and roll on the elliptical rolling path in the interior of the stator.

In this manner all four strokes of the working cycle of a four-stroke engine can be carried out within one revolution of the rotor through 360°, the angular velocity of the engine is reduced by half, with all the mechanical and thermodynamical advantages resulting therefrom, such as a considerable reduction of wear and loss of output power by friction and a reduction by 50% of the time of heat dissipation of the heated parts.

Friction may be reduced in a particularly advantageous manner by rotatably mounting the rollers on an axle secured with its end to the inner walls of the pistons and positive guiding of the pistons during their radially reciprocating movement may be obtained by providing a further roller of smaller size at each end of the axle, said further roller being arranged to engage and roll on a rolling path on the rotor to guide the pistons during their radially inward and outward movements, said rolling path on the rotor having an elliptical shape similar to said rolling path provided on the interior peripheral surface of the stator.

Complete sealing of the rotor around the combustion chamber relative to the peripheral inner wall of the stator, or preferably a distributor sleeve containing the inlet and exhaust apertures and secured to the inside of the stator, may be achieved by providing a tube segment around the combustion chamber, with the tube segment urged radially outwardly by a spring and peripherally surrounded by at least one piston ring.

Another object of the present invention is to provide an efficient cooling and lubricating system for all parts of the engine subject to the development of heat and to be actuated by the rotary movement of the rotor of the engine without use of a pump. This is achieved by providing a lubricating and cooling oil feed circuit including ducts extending through or adjacent to all moving parts of the engine subject to heating, this oil feed circuit communicating with an oil reservoir outside the engine and with the peripheral space between the rotor and stator so as to produce circulation of the oil in said circuit by the suction and compression effects caused at the rear of the pistons during rotation of the rotor.

Other objects and advantages of the invention will appear from the following detailed description of the drawings.

A preferred embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, in which:-

Figure 1 is a schematic diagram showing the four working phases in a four-stroke rotary combustion engine according to the invention;

Figure 2 is a longitudinal cross-section through the rotary combustion engine according to the invention;

Figure 3 is a transverse cross-section thereof, taken in the plane of the pistons;

Figure 4 is a transverse cross-section taken in the plane of the distributor;

Figure 5 is a transverse cross-section taken in the plane of the valve assembly of the lubricating and cooling system;

Figure 6 is a schematic representation of the lubricating and cooling circuit; and

Figure 7 is a transverse cross-section through the distributor.

Referring first to Figures 2 and 3, a rotary combustion engine according to the invention comprises a stator 1 in the form of a cylindrical metal housing and a rotor 2 also of cylindrical shape and mounted for rotation in the stator 1 by means of a shaft 9 projecting from the two ends thereof and supported in bearings 3. The rotor 2 is provided with a pair of radially opposed pistons 4 radially slidably mounted in the rotor 2 by means of a bearing sleeve 5 and each supporting at its radially outward end a roller 6 rotatably mounted on an axle 7 secured with its ends to the inner walls of the pistons 4. The rollers 6 roll on a rolling path 8 provided in the interior of the stator housing 1. This rolling path may be elliptical, pseudo-elliptical, trochoidal or of a similar cross-sectional shape, i.e. a shape formed of several connected curves adapted to produce a radially reciprocating movement of the pistons 4 as they roll with their rollers 6 engaging the rolling path 8 on the inside of the stator housing 1.

As shown in Figure 4, the rotor 2 is provided with a combustion chamber 10 formed integrally with the rotor, this combustion chamber serving also as an inlet chamber for the fuel mixture and as an exhaust chamber for the burnt gases. The rotor 2 is surrounded by a distributor sleeve 11 provided with a pair of peripherally spaced apertures 12, 13 communicating respectively with a fuel mixture inlet duct 14 and a burnt gas exhaust duct 15. The

distributor sleeve 11 also carries a spark plug 16 adapted to ignite the combustible mixture in the combustion chamber 10 as it passes adjacent the spark plug during rotation of the rotor. The spark plug may also be replaced by an injection nozzle.

The distributor sleeve 11 is mounted in a cup-shaped housing cover 20 (Figure 2) closing one end side of the rotor, the other side being closed by another cup-shaped housing cover 21. The cup-shaped housing covers 20 and 21 accommodate the bearings 3 in which the ends of the rotor 2 are rotatably mounted. Provided in the interior of each of the housing covers 20 and 21 is an elliptical rolling path 25 of a shape similar to that of the rolling path 8 in the interior of the stator housing 1. Each end of each axle 7 of the rollers 6 of the rotor 2 rotatably supports a roller 26 which rolls on the rolling path 25 during rotation of the rotor to guide the radially inward and outward movement of the pistons 4, particularly during the inlet stroke of the engine. The rollers 26 may also be replaced by sliding shoes 29.

As shown in Figure 4, the housing cover 20 is provided with a cooling fins 22 and the housing cover 21 is provided with similar cooling fins 23, as shown in Figure 5. Each of the housing covers 20 and 21 includes a central hub portion 24 and 24a, respectively, accommodating the bearings 3 of the shaft 9 of the rotor, as seen in Figure 2. The hub portion 24 also supports the aforementioned distributor sleeve 11 and contains the inlet duct 14 (Figure 4). Also the spark plug 16 is secured to the hub portion 24. The exhaust duct 15 is also located in the hub portion 24. Finally, the hub portion 24 is provided with lubricating and cooling oil feed ducts 27 and the hub portion 24a is provided with similar lubricating and cooling oil feed ducts 28, as shown particularly in Figure 5.

The lubricating and cooling oil feed circuit is shown more clearly in Figure 6. It includes an annular chamber 30 located in the hub portion 24 and a communicating through axial ducts 31 in the distributor sleeve 11 and axial ducts 32 in the rotor shaft 9 with labyrinth type annular ducts 33 surrounding the bearing sleeve 5 of the pistons 4. Thus, these ducts are located in the engine portions most subjected to heat. The lubricating and cooling oil flows from an oil reservoir 34 provided with an oil level gauge 35 through the inlet feed duct 28, labyrinth ducts 33 and axial ducts 31 and 32 into the annular chamber 30 and from there returns through the ducts 27 and the peripheral space between the rotor and stator and the return feed duct 28 into the oil reservoir 34. Circulation of the lubricating and cooling oil is effected by the suction produced at the rear of the pistons 4 during the compression and exhaust strokes of the engine when the oil enters the engine from the reservoir 34 whereas during the inlet and expansion strokes the oil is forced back into the reservoir 34.

As shown in Figure 7, the combustion chamber 10 is surrounded by a rigid tube segment 40 having its outer end suitably shaped to fit the peripheral inner surface of the distributor sleeve 11. The tube segment 40 is urged outwardly by a spring 41 inserted between its rear end and the bottom of a dead hole provided in the rotor shaft 9 for receiving the tube segment 40. One or more piston rings 42 surrounding the tube segment 40 ensure perfect sealing between the rotor shaft 9 and distributor sleeve 11.

As shown in Figure 2, the rotor shaft 9 carries at one end a power take-off wheel 45 and at the other end a cooling fan 46 secured directly to the rotor shaft for cooling the central hub portion of the engine including the distributor sleeve which is the hottest portion of the engine. A gear wheel 47, which may also be replaced by a pulley, is also mounted on the rotor shaft 9 outwardly of the cooling fan 46 to drive the spark plug ignition distributor and the dynamo. A carburetor 47 is provided upsteam of the fuel mixture inlet duct 14 in the conventional manner, as shown in Figure 4.

The operation of a four-stroke engine according to the invention will now be described with reference to Figure 1:

Figure 1 is subdivided into four separate Figures designated (I), (II), (III) and (IV), respectively, and representing the inlet stroke, compression stroke, ignition stroke and exhaust stroke, respectively. The rotor shaft 9 rotates in the direction of the arrow 50. In Figure 1 (I) the combustion chamber 10 in the rotor shaft 9 is just leaving the exhaust aperture 13 and is proceeding toward the inlet aperture 12 to receive the combustible mixture therein. In Figure 1 (II) the combustion chamber 10 is leaving the inlet aperture 12 to start the compression stroke. In Figure 1 (III) the combustion chamber 10 is opposite the spark plug 16 which ignites the compressed combustible mixture in the combustion chamber 10. This is the ignition stroke. In Figure 1 (IV) the combustion chamber 10 is approaching the exhaust aperture 13 to start the exhaust stroke.

As the pistons 4 perform a reciprocating movement twice during each complete revolution of the rotor, all four strokes of the working cycle of the four-stoke engine are carried out within one revolution of the rotor through 360°. Thus no reduction gear is required for the ignition distributor and the angular velocity of the engine is reduced by half, with all the mechanical and thermodynamical advantages resulting therefrom, such as a considerable reduction of wear and loss of power by friction and a reduction by 50% of the time of heat dissipation of the heated parts so that a substantial amount of heat is saved.

CLAIMS

1. In a rotary combustion engine of the type comprising a substantially cylindrical stator provided in its interior with an elliptical rolling path, inlet and exhaust apertures in the stator for receiving and exhausting a combustible fuel mixture into and from the interior of said stator, ignition means secured to the periphery of said stator, said ignition means having a forward ignition end extending substantially flush and communicating with the interior of said stator, and a rotor having a cylindrical peripheral outer surface provided with a combustion chamber open toward said cylindrical peripheral outer surface, said rotor being arranged to rotate

with portions of its periphery engaging said elliptical rolling path in said stator, the improvement comprising a pair of radially opposed pistons reciprocably mounted in a bearing sleeve extending radially through the longitudinal central portion of said rotor and each supporting at its radially outward end a roller arranged to engage and roll on said elliptical rolling path in the interior of said stator.

2. A rotary combustion engine as claimed in claim 1, wherein each of said rollers is rotatably mounted on an axle secured with its ends to inner walls of said pistons and at each end of said axle a roller is provided arranged to engage and roll on a rolling path on said rotor to guide said pistons during their radially inward and outward movements, said rolling path on said rotor being of elliptical shape similar to said rolling path provided on the interior peripheral surface of said stator.

3. A rotary combustion engine as claimed in claim 1, wherein said rotor is surrounded by a distributor sleeve firmly secured to said stator and containing said inlet and exhaust apertures and also said spark plug, said distributor sleeve being mounted in a cup-shaped housing cover closing off one end side of the rotor, the other end side being closed by another cup-shaped housing cover.

4. A rotary combustion engine as claimed in claim 1, wherein said combustion chamber in said rotor is surrounded by a tube segment urged radially outwardly by a spring and peripherally surrounded by at least one piston ring.

5. A rotary combustion engine as claimed in claim 1, wherein a lubricating and cooling oil feed circuit is provided with ducts extending through or adjacent to all moving parts of the engine subject to heating, said oil feed circuit communicating with an oil reservoir outside the engine and with the space between the rotor and stator so as to produce circulation of the oil in said circuit by the suction and compression effects caused at the rear of said pistons during rotation of the rotor.

6. A rotary combustion engine as claimed in claim 5, wherein said lubricating and cooling oil feed circuit comprises an oil inlet duct leading from said oil reservoir to a plurality of labyrinth ducts surrounding said bearing sleeve, a plurality of axial ducts communicating with said labyrinth ducts and extending axially through said rotor and stator to an annular chamber located in a cup-shaped housing cover for the rotor, said cup-shaped housing cover being located at an axial end of the rotor in opposition to another cup-shaped housing cover located at the other axial end of the rotor, said latter cup-shaped housing cover containing said oil inlet duct, ducts leading from said annular chamber to the peripheral space between the rotor and stator, and a return feed duct extending from said peripheral space to said oil reservoir.

7. A rotary combustion engine substantially as hereinbefore described with reference to and as illustrated by the accompanying drawings.

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ASSIGNEE-INFORMATION:

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BARBAGALLO S	N/A

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EUR-CL (EPC): F01B013/06 ; F02B057/10, F01C011/00

US-CL-CURRENT: 123/44E

ABSTRACT:

CHG DATE=19990617 STATUS=O> A stator 1 provided in its interior with elliptical rolling paths 8, 25 contains a rotor 2 having a cylindrical outer surface and radially traversed by a cylinder sleeve 5 for a pair of radially reciprocable pistons 4 each supporting a roller 6 at its outward end engaging the elliptical rolling path 8. The rotor 2 is provided with a combustion chamber 10 open toward a distributor sleeve 11 secured to the stator 1 and provided with an inlet aperture (12), Figure 4 (not shown), and an exhaust aperture (13) as well as a spark plug 16 or a fuel injector. A lubricating and cooling oil feed circuit 30 to 33 extends through the engine and the oil flows therethrough due to the pumping produced at the rear of the pistons 4 during rotation of the rotor. <IMAGE>